
Space Weather Forecast

Issued on Wednesday 25 December 2024 at 12:00 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Minor/Moderate (R1/R2) radio blackouts expected at times throughout. Minor/Moderate (G1/G2) geomagnetic storm likely in next 24 hours from inbound CME.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate, with several Moderate-class flares observed, mostly from the complex of spots near the south-central part of the Sun, however the peak flare emanated from a region in the northeast at 25/0444UTC.

There are now up to eleven sunspot regions on the facing side, with one no longer visible on the southwestern horizon, a second fading away, and a third hovering into view over the southeastern horizon. The most-changed regions included one in the northeast, which saw strong areal growth in its northern intermediate spots. Another group near centre-disc showed proliferation in its intermediate portions, which was matched at the same longitude by development in the trailing spots of a region to its immediate south. A third active region in the southeast showed the reverse trend, with areal decay throughout - especially in its leading group. All the magnetically unipolar groups were unchanged, aside from one in the northeast, which consolidated and faded in the period.

A Type II radio emission was observed at 25/0447UTC (usually correlating with Coronal Mass Ejections (CMEs)). This was almost concurrent with the peak flare of the period, however recent imagery instead suggests a large and fast CME from the southeast is perhaps the most likely culprit.

Ground-based imagery for the period is intermittent, however the cohort of 'filaments' (arcs of plasma) that started the 24-hour period appear to still be in place, further implying that there have been no significant Earth-directed events. Current thoughts are therefore that no new Earth-directed CMEs are en route.

Solar Wind / Geomagnetic Activity: Solar winds showed a waning connection to a coronal hole fast wind. The solar wind speed fell from elevated levels to reach slightly elevated levels by the period's end. The number of particles in the solar wind showed a concurrent rise within normal background, which is perhaps the resumption of the ambient wind density. The associated magnetic field was at typical levels, with a small-scale erratic north-south component.

The net result of the above solar wind measures was for provisionally mostly quiet geomagnetic activity.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) showed a continuing gradual decline from an event on 19 December, with the current 24-hour period seeing an early 'peak' near 2pfu, i.e. comfortably below the 10pfu S1/Minor Radiation Storm threshold.

Four-Day Space Weather Forecast Summary

Solar Activity: Further Moderate-class flares are expected, with a slight chance of isolated Strong-class flares throughout. No significant regions are due to depart the facing side of the Sun, however the oncoming southeastern horizon may yet warrant a revision of the daily risk when any regions here become more visible.

Solar Wind / Geomagnetic Activity: A CME from 23 December may give a glancing blow at Earth on Day 1 or Day 2 (25-26 December), with some uncertainty in the timing of this feature. No other CMEs currently feature in the forecast, although confidence in this aspect of the forecast is lower than usual. Solar winds are elevated but slowly declining due to a waning connection to a 'coronal hole'.

Geomagnetic activity is expected to be mainly quiet at first. Later Day 1 into Day 2, peak G1-G2/Minor-Moderate Storm levels are likely, with a slight chance of G3/Strong Storm intervals, due to potential CME influence. By Days 3 and 4 (27-28 December), mainly quiet activity is forecast, but with lower confidence given the uncertainty in the CME forecast.

Energetic Particles / Solar Radiation: There is a slight chance of S1/Minor Radiation Storm or greater enhancements during the period. In the absence of any further notable flares, ongoing slightly enhanced high-energy proton counts should ease towards background levels in the coming days.

Geomagnetic Storms

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	50	60	10	5
Strong	G3	No	5	10	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	80	80	80	80
Very Active	R3-R5 (X Class)	No	10	10	10	10

Solar Radiation Storms (High Energy Protons)

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	15	15
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = cm ⁻² sr ⁻¹ s ⁻¹)						